

Appl. No. 09/852,847
Amendment and/or Response
Reply to th Office Action of April 11, 2003

Page 3 of 14

Amendments to the Claims:

A clean version of the entire set of pending claims (including amendments to the claims, if any) is submitted herewith per 37 CFR 1.121(c). This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1-8. (Cancelled)

9. (Withdrawn) A manufacturing method of semiconductor device comprising:

- a step of a nearly concave groove of a specified depth in the boundary region of a circuit forming surface of semiconductor elements, in a semiconductor wafer having a region for plural semiconductor elements forming specified circuits,
- a step of forming an insulating layer in a specified region of the side surface of said nearly concave groove and circuit forming surface,
- a step of forming a wiring in a specified region of said circuit forming surface including the entire surface of the inside of the nearly concave groove,
- a step of forming a bump electrode of a specified height on a boundary region including the inside of the nearly concave groove forming said wiring,
- a step of sealing the circuit forming surface with a resin exposing the surface of said bump electrode,
- a step of polishing a confronting surface of the circuit forming surface of said semiconductor wafer and exposing the nearly concave groove from said confronting surface,
- a step of sealing the entire confronting surface of the circuit forming surface of the semiconductor wafer with resin, including the end portion of the wiring formed at the exposed side surface of the nearly concave groove,
- a step of forming a ball electrode on said bump electrode,

Atty. Docket No. OKI.234

Appl. No. 09/852,847
Amendment and/or Response
Reply to the Office Action of April 11, 2003

Page 4 of 14

a step of cutting the semiconductor wafer along the exposed nearly concave groove, and forming plural semiconductor devices at the side surface thereof exposing said ball electrode, bump electrode and wiring, and

a step of heating the divided semiconductor devices at specified temperature, and forming a part of the ball electrode formed on the bump electrode on the wiring at the side surface of the semiconductor element.

10. (Withdrawn) The manufacturing method of semiconductor device of claim 9, further comprising:

a step of removing the resin formed in the exposed nearly concave groove from the confronting surface,

between the step of sealing the entire confronting surface of the circuit forming surface of the semiconductor wafer with resin, and the step of forming a ball electrode on said bump electrode.

11. (Withdrawn) The manufacturing method of semiconductor device of claim 10, wherein the step of removing the resin formed in the exposed nearly concave groove from the confronting surface is a step of removing the resin by using laser.

12. (Withdrawn) A manufacturing method of stack type semiconductor device comprising:

a step of mounting a semiconductor device of claim 1 on a second semiconductor device having ball electrodes for connecting electrically to other semiconductor device, with the confronting surface of the circuit forming surface as a contact surface, so that said ball electrodes of said second semiconductor device and the re-wiring formed at the side surface of the semiconductor device of claim 1 may be nearly at same positions, and

a step of heating the second semiconductor device mounting the

Appl. N . 09/852,847
Amendment and/or Response
Reply to the Office Action f April 11, 2003

Page 5 f 14

semiconductor device of claim 1 at a specified temperature, and connecting the bump electrodes of the semiconductor device of claim 1 and the wiring formed at the side surface of the semiconductor device to the second semiconductor device through said ball electrodes.

13. (Withdrawn) A manufacturing method of stack type semiconductor device comprising:

a step of mounting a semiconductor device of claim 4 on a second semiconductor device having ball electrodes for connecting electrically to other semiconductor device, with the confronting surface of the circuit forming surface as a contact surface, so that said ball electrodes of said second semiconductor device and the re-wiring formed at the side surface of the semiconductor device of claim 4 may be nearly at same positions, and

a step of heating the second semiconductor device mounting the semiconductor device of claim 4 at a specified temperature, and connecting the bump electrodes of the semiconductor device of claim 4 and the wiring formed at the side surface of the semiconductor device to the second semiconductor device through said ball electrodes.

14. (Withdrawn) A manufacturing method of stack type semiconductor device comprising:

a step of mounting a semiconductor device of claim 1 on a second semiconductor device having ball electrodes for connecting electrically to other semiconductor device, with the confronting surface of the circuit forming surface as a contact surface, so that said ball electrodes of said second semiconductor device and the re-wiring formed at the side surface of the semiconductor device of claim 1 may be nearly at same positions,

a step of mounting one or two or more semiconductor devices of claim 1, with

Atty. Docket No. OKI.234

Appl. No. 09/852,847
Amendment and/or Re p nse
Reply to the Office Acti n of April 11, 2003

Page 6 f 14

the confronting surface of the circuit forming surface as a contact surface, so that the re-wirings formed at the side surface of the semiconductor devices of claim 1 may be nearly at same positions, sequentially further on the semiconductor device of claim 1 mounted on the second semiconductor device, and

a step of heating the second semiconductor device mounting the plural semiconductor devices of claim 1 at a specified temperature, and connecting the bump electrodes of the plural semiconductor devices of claim 1 and the wiring formed at the side surface of the semiconductor device, mutually to the second semiconductor device and the plural semiconductor devices of claim 1 through said ball electrodes.

15. (Withdrawn) A manufacturing method of stack type semiconductor device comprising:

a step of mounting a semiconductor device of claim 4 on a second semiconductor device having ball electrodes for connecting electrically to other semiconductor device, with the confronting surface of the circuit forming surface as a contact surface, so that said ball electrodes of said second semiconductor device and the re-wiring formed at the side surface of the semiconductor device of claim 4 may be nearly at same positions,

a step of mounting one or two or more semiconductor devices of claim 4, with the confronting surface of the circuit forming surface as a contact surface, so that the re-wirings formed at the side surface of the semiconductor devices of claim 4 may be nearly at same positions, sequentially further on the semiconductor device of claim 4 mounted on the second semiconductor device, and

a step of heating the second semiconductor device mounting the plural semiconductor devices of claim 4 at a specified temperature, and connecting the bump electrodes of the plural semiconductor devices of claim 4 and the wiring formed at the side surface of th semiconductor device, mutually to th second

Appl. No. 09/852,847
Amendment and/or Response
Reply to the Office Action of April 11, 2003

Page 7 of 14

semiconductor device and the plural semiconductor devices of claim 4 through said ball electrodes.

16. (Withdrawn) A manufacturing method of stack type semiconductor device comprising: a step of mounting a semiconductor device of claim 1 on a second semiconductor device having ball electrodes for connecting electrically to other semiconductor device, with the confronting surface of the circuit forming surface as a contact surface, so that said ball electrodes of said second semiconductor device and the re-wiring formed at the side surface of the semiconductor device of claim 1 may be nearly at same positions,

a step of mounting one or two or more semiconductor devices of claim 1, or semiconductors each comprising a semiconductor element having plural electrodes on a circuit forming surface, a wiring formed at least on said circuit forming surface, having one end connected to said electrodes, a bump electrode connected to said wiring, a sealing resin for exposing the surface of said bump electrode and sealing the circuit forming surface of said semiconductor element, and a ball electrode formed on the surface of said bump electrode exposed from said resin, in which a part of said wiring is formed also at the side surface of said semiconductor element, and said bump electrode is formed so that the side surface of the bump electrode may be nearly flush with said wiring formed at the side surface of said semiconductor element, at least a part of said ball electrode is formed so as to be electrically connected to said wiring at the side surface of said semiconductor element, and the side surface of said semiconductor element is sealed with resin exposing said wiring, and the confronting surface of said circuit forming surface is sealed with resin on the other surface than the end surface of the wiring formed at the side surface of the semiconductor element, with the confronting surface of the circuit forming surface as a contact surface, so that the re-wirings formed at the side surface of such semiconductor devices may be nearly at same positions, sequentially further on the

Atty. Docket No. OKI.234

Appl. No. 09/852,847
Amendment and/ or Response
Reply to the Office Action of April 11, 2003

Page 8 of 14

semiconductor device of claim 1 mounted on the second semiconductor device, and a step of heating the second semiconductor device mounting the plural semiconductor devices at a specified temperature, and connecting the bump electrodes of the plural semiconductor devices and the wiring formed at the side surface of the semiconductor device, mutually to the second semiconductor device and the plural semiconductor devices through said ball electrodes.

17. (Withdrawn) A manufacturing method of stack type semiconductor device comprising:

a step of mounting a semiconductor device of claim 4 on a second semiconductor device having ball electrodes for connecting electrically to other semiconductor device, with the confronting surface of the circuit forming surface as a contact surface, so that said ball electrodes of said second semiconductor device and the re-wiring formed at the side surface of the semiconductor device of claim 4 may be nearly at same positions,

a step of mounting one or two or more semiconductor devices of claim 4, or semiconductors each comprising a semiconductor element having plural electrodes on a circuit forming surface, a wiring formed at least on said circuit forming surface, having one end connected to said electrodes, a bump electrode connected to said wiring, a sealing resin for exposing the surface of said bump electrode and sealing the circuit forming surface of said semiconductor element, and a ball electrode formed on the surface of said bump electrode exposed from said resin, wherein a part of said wiring is formed also at the side surface of said semiconductor element, and said bump electrode is formed so that the side surface of the bump electrode may be nearly flush with said wiring formed at the side surface of said semiconductor element, at least a part of said ball electrode is formed so as to be electrically connected to said wiring at the side surface of said semiconductor element, and the side surface of said semiconductor element is sealed with resin exposing said wiring,

Appl. N . 09/852,847
Amendment and/or Response
Reply to the Office Action of April 11, 2003

Page 9 of 14

and the confronting surface of said circuit forming surface is sealed with resin on the entire surface including the end surface of the wiring formed at the side surface of the semiconductor element, with the confronting surface of the circuit forming surface as a contact surface, so that the re-wirings formed at the side surface of such semiconductor devices may be nearly at same positions, sequentially further on the semiconductor device of claim 4 mounted on the second semiconductor device, and

a step of heating the second semiconductor device mounting the plural semiconductor devices at a specified temperature, and connecting the bump electrodes of the plural semiconductor devices and the wiring formed at the side surface of the semiconductor device, mutually to the second semiconductor device and the plural semiconductor devices through said ball electrodes.

18. (Previously Presented) A semiconductor device, comprising:

a semiconductor element having a circuit forming surface;
a wiring disposed on said circuit forming surface and on a side surface of said semiconductor element;
a sealed bump electrode connected to said wiring, said sealed bump electrode having an exposed surface;
a ball electrode disposed on said exposed surface of said bump electrode;
and
a sealed confronting surface of said circuit forming surface.

19. (Previously Presented) A semiconductor device as recited in claim 18, further comprising a plurality of electrodes on said circuit forming surface.

20. (Previously Presented) A semiconductor device as recited in claim 18, wherein said wiring on said side surface has an end that is sealed.

Atty. Docket No. OKI.234

Appl. N . 09/852,847
Amendment and/or Response
Reply to Office Action of April 11, 2003

Page 10 of 14

21. (Previously Presented) A semiconductor device as recited in claim 18, wherein said sealed bump electrode and said sealed confronting surface are resin sealed.
22. (Previously Presented) A semiconductor device as recited in claim 18, wherein said sealed confronting surface is entirely sealed.
23. (Previously Presented) A semiconductor device as recited in claim 18, wherein the semiconductor device is mounted on another semiconductor device with said confronting surface as a contacting surface.
24. (Previously Presented) A semiconductor device as recited in claim 23, wherein said another semiconductor device has electrodes that are connected to said wiring of the semiconductor device.
25. (Previously Presented) A semiconductor device as recited in claim 19, wherein the semiconductor device is mounted on another semiconductor device with said confronting surface as a contacting surface, and said another semiconductor device has electrodes that are connected to said wiring and to at least one of said plurality of electrodes.
26. (Previously Presented) A semiconductor device as recited in claim 23, wherein said another semiconductor device is disposed over a plurality of other semiconductor devices.
27. (Previously Presented) A semiconductor device as recited in claim 18, wherein at least a part of said ball electrode is disposed on said wiring disposed on said side surface of said semiconductor element.